K-Nearest Neighbors

Nipun Batra

IIT Gandhinagar

July 30, 2025

Low values of K will result in each point having a very high influence on the final output \implies noise will influence the result

Low values of K will result in each point having a very high influence on the final output ⇒ noise will influence the result

High values of K will result in smoother decision boundaries

⇒ lower variance but also higher bias

Why is feature scaling important for KNN?

Why is feature scaling important for KNN?

Why is feature scaling important for KNN? In which scenarios would you prefer KNN over parametric methods?

Why is feature scaling important for KNN? In which scenarios would you prefer KNN over parametric methods?

Why is feature scaling important for KNN?

In which scenarios would you prefer KNN over parametric methods?

What is the time complexity of finding *k* nearest neighbors naively?

Non-parametric: KNN makes no assumptions about data distribution

Non-parametric: KNN makes no assumptions about data distribution

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \rightarrow$ high variance, large $k \rightarrow$ high bias

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \rightarrow$ high variance, large $k \rightarrow$ high bias

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \to \text{high variance}$, large $k \to \text{high bias}$
- Distance Metrics: Choice affects performance significantly

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \to \text{high variance}$, large $k \to \text{high bias}$
- Distance Metrics: Choice affects performance significantly

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \to \text{high variance}$, large $k \to \text{high bias}$
- Distance Metrics: Choice affects performance significantly
- Curse of Dimensionality: Performance degrades in high dimensions

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \to \text{high variance}$, large $k \to \text{high bias}$
- Distance Metrics: Choice affects performance significantly
- Curse of Dimensionality: Performance degrades in high dimensions

- Non-parametric: KNN makes no assumptions about data distribution
- Lazy Learning: No training phase, computation happens at prediction time
- Choice of k: Small $k \to \text{high variance}$, large $k \to \text{high bias}$
- Distance Metrics: Choice affects performance significantly
- Curse of Dimensionality: Performance degrades in high dimensions
- Scalability: Approximate methods needed for large datasets